NAME:

## at1125paper: Derivation of Quadratic Formula

Begin with a generalized quadratic equation in standard form.

$$ax^2 + bx + c \;=\; 0$$

Subtract $c$ from both sides.

Divide both sides by $a$. On the left side, distribute the divisor, and simplify the quadratic term.

Complete the square by adding the square of half the linear coefficient to both sides of the equation.

$$x^2 + \frac{bx}{a} + \left(\frac{b}{2a}\right)^2 \;=\; \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

Factor the perfect square. (Factor the left side of the equation.)

On the right side, distribute the exponent to all three factors of the quotient.

On the right side, make a common denominator.

On right side, combine fractions.

$$\left(x + \frac{b}{2a}\right)^2 \;=\; \frac{b^2 - 4ac}{4a^2}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

Undo the squaring.

Get $x$ by itself.

Distribute the radical over the division in the last term.

$$x = \frac{-b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{\sqrt{4a^2}}$$

Simplify the denominator.

Combine the fractions.